

In the Specification:

On page 1, replace the paragraph beginning at line 12 with the following:

A₁ Electrophoresis which makes use of capillaries has been used for the purpose of determining, for example, base sequencing and base length of DNA. When a specimen containing DNA which is the object of measurement is injected into gel such as polyacrylamide within a glass capillary and a voltage is applied between both ends of the capillary, DNA compounds in the specimen move in the capillary and are separated depending on such as their molecular weights to form DNA bands within the capillary. Since a fluorescent coloring matter is added for the respective DNA bands, when laser beam is irradiated thereto, light is emitted therefrom, thus through reading of the emitted light by means of a fluorescent measurement means the sequencing of DNA is determined. The separation and analysis of protein are performed in a like manner to examine the structure of the protein.

On page 2, replace the paragraph beginning at line 3 with the following:

A₂ One such laser beam irradiation method is as follows. In a capillary array constituted by a plurality of capillaries, a cover coating such as polyamide on the surface of the capillaries is removed to form a detection portion, laser beam is irradiated to a capillary located at one side or capillaries located at both sides in the detection portion and the laser beam irradiated in such a manner passes across the plurality of capillaries.

On page 3, replace the paragraphs beginning at lines 7 and 22 with the following:

A₃ (1) An irradiation optical axis making incident in parallel direction with respect to the capillary array plane face is inclined in non-perpendicular direction with respect to the longitudinal direction of the capillaries. Thus, the reflected beam from the capillaries is not overlapped on the laser beam axis, thereby, no noises are introduced.

A4

(3) Incident angles of two laser beam optical axes irradiated from both sides of the capillary plane face which cross each other in parallel direction with respect to the capillary array plane face are differentiated from each other.

On page 6, replace the paragraph beginning at line 21 with the following:

AS

When the orthogonal projections of the two incident laser beams with respect to the plane face formed by the capillary array are not parallel as referred to above, the following problem may arise. Since the laser beam diameter when adding the two laser beams becomes large in comparison with when the two laser beams are coaxial, therefore, it is feared that spatial resolution in a fluorescent detection is reduced. Namely, in an electrophoresis, DNA compounds in the specimen move in the capillary and are separated depending on, for example, their molecular weights to form DNA bands within the capillary. In such an instance, it is possible that the resolution detection capability of these DNA bands is reduced. In order to avoid those possibilities, it is preferable that the centers of the two laser beams overlap each other near the center of the capillary array. When the two laser beams are arranged like this, the expansion of the laser beam diameter is minimized.

On page 8, replace the paragraph beginning at line 1 with the following:

A6

In the above explained method of realizing the laser beam optical axis, the position of the lenses is adjusted so that the laser beams are guided to correct positions of the capillaries. Accordingly, it is preferable that a fine adjustment function for the condenser lenses is provided. With respect to the direction of the laser beam optical axis, when the focal distance of the condenser lenses is 50mm, the positional accuracy of the lenses required for the above direction is about 1mm, therefore, with regard to this direction no positional adjustment function is necessarily required. However, with regard to the two axes perpendicular to the laser beam optical axis, when the ratio of inner diameter/outer diameter of the capillaries is $50\mu\text{m}/320\mu\text{m}$, a positional accuracy of about

A6 10 μ m is required. In this instance, if a screw having a pitch of about 0.5mm is used as a screw for adjusting the position of the condenser lenses, the requirement will be satisfied.

On page 9, replace the paragraph beginning at line 3 with the following:

A7 In the present invention, since the laser beam optical axis is not perpendicular to the capillary axis, when the capillaries are disposed horizontally, the laser beam optical axis can not direct in vertical direction. As a multi-capillary detection means, a two dimensional CCD (Charge Coupled Device) camera is frequently used. In such instance, one dimension among two dimensions of the CCD camera is aligned along the arrangement direction of the capillaries as an axis for detecting signals from the respective capillaries and the other dimensional axis is aligned along a wave length dispersion direction of fluorescent light emitted from the respective capillaries. Namely, the latter direction is determined as the direction for dispersing the emitted light from the single capillary by making use of a grating and a prism. In the present invention, although the capillary axis and the laser beam optical axis are not substantially perpendicular, in an electrophoresis apparatus which makes use of a CCD in a fluorescent detection means, it is preferable that a pixel grid in the CCD is parallel to the optical axis of the laser beam passing through the capillaries rather than substantially parallel to the capillary axis in view of taking-in of data from the CCD.

On page 10, replace the paragraph beginning at line 1 with the following:

Ax Further, in an electrophoresis apparatus, including a wave length dispersion means such as a grating and a prism in a fluorescent detection means according to the present invention, it is preferable that the wave length dispersion direction of the wave length dispersion means and the optical axis of the laser beam passing the capillaries are substantially perpendicular to each other in view of taking-in of data from the CCD.

On page 12, replace the paragraph beginning at line 3 with the following:

A9

Fig. 12A shows an image formed on CCDs of a light-emitting substance that is parallel to grooves in a grating and Fig. 12B is a diagram showing in skeleton of a light intensity distribution of an incident laser beam on a capillary array;

On page 13, replace the paragraph beginning at line 26 with the following:

A10

Figs. 3A through 3C show skeleton diagrams near a detection portion of a capillary array and a laser beam introduction route. Since elements such as a shutter and a filter used for laser beam are well known in the field concerned and are not a direct object of the present invention, the illustration thereof is omitted for the sake of simplicity. Fig. 3A is a schematic front view of a major portion of an electrophoresis apparatus according to the present embodiment, Fig. 3B is an upper side view of the detection portion of the capillary array and Fig. 3C is a plane view of a pin hole plate which is attached at an emission port of a laser beam source. A capillary array is formed by arranging 16 pieces of capillaries 21 on an array stand 20 and by securing the same thereon. Hereinafter, a plane face formed by the center axes of 16 pieces of capillaries 21 on the array stand 20 and an imaginary plane face formed by extending the former plane face over the entire space are called an array face 22. Further, an imaginary straight line which is in the array face is perpendicular to 16 pieces of capillary axes and passes through the center of the detection portion is called a standard optical axis 28 (see Fig. 3A). The capillaries are made of a quartz glass tube covered by a polymer thin film, however, at the detection portion the polymer covering is removed and the quartz glass is exposed. The inner diameter/outer diameter ratio of the quartz glass tube is 50/320 μ m and the outer diameter of the capillary including the polymer thin film is 363 μ m. The pitch of the capillaries is 363 μ m same as the capillary outer diameter and the width of the array is 363 μ m \times 16=5.8mm.

On page 15, replace the paragraph beginning at line 19 with the following:

A11
Reflection of the incident laser beam is caused at an interface of air/capillary outer wall and at a capillary inner wall/gel interface. In particular, since a refractive index difference at the interface of air/capillary outer wall is large, the reflection light intensity thereat becomes large. Since there exists two interfaces of air/capillary outer wall for every capillary, reflection is caused from 32 interfaces of air/capillary outer wall of 16 pieces of capillaries.

On page 16, replace the paragraph beginning at line 26 with the following:

A12
Fig. 18 shows a signal intensity distribution for the 16 pieces of capillaries in the embodiment 1 above. As will be seen from Fig. 18, when the laser beam is introduced only at one side face of the capillary array, variations of signal intensities among the 16 pieces of capillaries are enlarged. According to the present embodiment, the laser beams are introduced from both side faces of the capillary array, thereby, the dispersion of the signal intensities from the 16 pieces of capillaries is reduced.

On page 17, replace the paragraph beginning at line 9 with the following:

A13
Fig. 1 shows a skeleton diagram of embodiment 2 according to the present invention, in which only the vicinity of the detection portion of the capillary array and the laser beam introduction route thereof are illustrated and the illustration of the elements such as a shutter and a filter used for the laser beam is omitted. The structure of the capillary array in embodiment 2 is identical to that in embodiment 1. Further, the name of parts and the definition of terms in the present embodiment are the same as those in embodiment 1 if not otherwise defined. A laser beam 40 is equally divided into two by a half mirror 41 and these two laser beams are irradiated to a capillary array from both side faces thereof. The reflection light by the half mirror 41 is identified as laser beam 43 and the transmitted light is identified as laser beam 44. The condenser lens for the laser beam

A13 43 is identified as a condenser lens 45 and the condenser lens for the laser beam 44 is identified as a condenser lens 46.

On page 18, replace the paragraph beginning at line 2 with the following:

A14 A capillary positioned at one end of the array and to which the laser beam 43 is first introduced is identified as first capillary 65 hereinbelow and another capillary to which the laser beam 44 is first introduced is identified as 16th capillary 66 hereinbelow. The optical axis layout of the laser beam 43 is the same as that in the embodiment 1. Further, the optical axis layout of the laser beam 44 is in symmetry to that of the laser beam 43 with respect to the capillary array. The optical axes of the laser beams 43 and 44 are adjusted in such a manner that the laser beams 43 and 44 are coaxial and one of the laser beams which passes through the capillaries further passes coaxially through the optical axis of the other incident laser beam and returns to the laser beam source 49. Respective reflection lights 47 and 48 from the capillaries of the laser beams 43 and 44 run in non coaxial manner with respect to the two laser beams 43 and 44 as illustrated in Fig. 1. Like the embodiment 1, at the laser beam emission port of the laser beam source 49 a pin hole plate 51 having a pin hole of a 1.4mm diameter is attached so as to prevent the reflection lights from returning to the laser beam source or the laser oscillator 49. Although the transmitted lights through the capillaries return to the emission port of the laser beam source 49, the returning of the reflection lights to the laser beam source 49 is prevented, thereby, a comparatively stable laser oscillation can be obtained.

On page 19, replace the paragraph beginning at line 5 with the following:

A15 Fig. 4A shows a skeleton diagram of a fluorescent detection system according to the present embodiment. An emission light 53 from the capillaries 42 is converted into a parallel light by an emission light condenser lens 54 of $f=1.4$ and the parallel emission light is introduced to a transmission type grating 55. Lights 56 and 57 spectrumed by the grating 55 are focused on a two dimension CCD 59 by an image formation lens 58. The wavelength dispersion direction by the grating 55 is substantially perpendicular with respect

A15
to the laser beam optical axis. Thereby, among two orthogonally crossing axes on the two dimension CCD 59, one of the axes represents a spatial coordinate in the alignment direction of the 16 pieces of the capillaries and the other axis represents emission light spectrums of the respective capillaries.

On page 20, replace the paragraph beginning at line 12 with the following:

A16
Laying out the optical axis according to the present embodiment is realized by making use of a set of the pin hole plates as shown in Fig. 5A. At first, the laser beam condenser lenses 45 and 46 are removed from the electrophoresis apparatus, then pin hole plates 67 and 68 in which pin holes are formed as illustrated in Fig. 5A are disposed at the positions where the laser beam condenser lenses 45 and 46 were disposed. Hereinafter, a crossing line between the pin hole plate and the array face is called as an array reference line 64 and a crossing point of a straight line which is perpendicular to the pin hole plate and passes through the center position of detection portion for the first capillary with the pin hole plate is called a pin hole reference point 69.

On page 23, replace the paragraph beginning at line 14 with the following:

A17
Further, a reflection light of the incident laser beam which is reflected only once from the surface of the capillaries is incident on a lens in the fluorescent detection system, and such direct reflection light is eliminated by an optical filter.

On page 23, replace the paragraph beginning at line 21 with the following:

A18
Figs. 9A and 9B show skeleton diagrams of embodiment 3 according to the present invention. Fig. 9A is a front view thereof and Fig. 9B is a side view thereof, in which only the vicinity of the detection portion of the capillary array and the laser beam introduction route thereof are illustrated and the illustration of the elements such as a shutter and a filter used for the laser beam is omitted. In the present embodiment, no incident laser beams run on the array face 22 and the laser beam makes incident with an angle θ of about 2° with respect to the array face 22. The structure of the capillary array

A18
in embodiment 3 is identical to that in embodiment 2. Further, the names of parts and the definition of terms in the present embodiment are the same as those in embodiments 1 and 2 if not otherwise defined.

On page 34, replace the paragraph beginning at line 26 with the following:

NE
In other words, the above will be explained as follows, when injecting urea aqueous solution of density 8M and refractive index of 1.41 into all of the capillaries and noting a certain specific Raman band effected by the incident laser beam 43 as the excitation light source, the position of formed image of the Raman band from the first capillary in the image spectrured by the grating moves toward a short wavelength in comparison with the position of formed image of the Raman band from the 16th capillary, further, when noting a certain specific Raman band effected by the incident laser beam 44 as the excitation light source, the position of formed image of the Raman band from the 16th capillary in the image spectrured by the grating moves toward a short wavelength in comparison with the position of formed image of the Raman band from the first capillary.